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华南滨海区耐盐园林绿化植物筛选与应用

Application and Screening of Salt-tolerant Landscaping Plant Resources in the Coastal Areas of South China

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目 录

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摘　要

土壤盐渍化已成为危及人类生存的重大资源与环境问题。随着城市化进程的加快，华南滨海地区盐渍化土壤面积不断增加。土壤盐碱化、植被覆盖率低、园林绿化质量欠佳已成为该地区园林绿化和生态环境建设的瓶颈。

华南滨海地区树种资源十分丰富，绝大部分树种的耐盐能力还不清楚，许多优良的耐盐树种尚未得到利用，有必要尽快组织力量开展筛选耐盐园林绿化植物的工作。在盐碱地上直接调查耐盐树种是筛选具有开发利用前景的盐生植物的一种最有效也是最经济的措施。开展华南滨海耐盐园林绿化植物资源调查筛选及应用研究，对改善华南滨海园林绿化质量，降低工程费用和养护管理费用，保护生态环境、维持生物多样性等方面具有重要意义。

本文通过对华南滨海耐盐园林绿化植物进行野外调查，详细记录植物种类名称、生长状况、盐害程度、生境特征及周边植物种类；采集土壤和水样测定含盐量，对该地区盐碱土绿化植物的耐盐范围进行测定评价，筛选和发掘华南滨海耐盐园林植物资源，并应用于厦门海湾大道园林植物的选择与配置。这些研究旨在为耐盐绿化树种的选择配置提供科学依据，并为华南滨海地区盐碱城市的绿化工作提供借鉴与参考。

本论文主要进行了以下三方面的研究工作：

1. 华南滨海耐盐园林绿化植物资源的调查与筛选研究。

本文调查历时 3 年，调查地点包括海南全岛海岸线、广东深圳海岸线、广东湛江海岸线、广西海岸线（包括涠州岛）、厦门海岸线、福建泉州湾等。采取野外调查、室内试验与资料查阅相结合的方法，对各调查点的盐碱土绿化植物的耐盐范围进行测定评价以及耐盐观赏植物的筛选。详细记录植物种类名称、生长状况、盐害程度、生境特征及周边植物种类，并采用电导率法测定土壤含盐量。依据赵可夫划分方法，并结合植物的生长发育状况，将植物的耐盐程度分为 4 级，为进一步开展华南滨海耐盐园林绿化植物的应用研究提供可靠的基础。

2. 开展华南滨海耐盐园林绿化植物的应用研究

探讨了影响滨海地区园林植物种类选择与配置的因素，分析了华南滨海耐盐园林植物选择配置特点，指出了华南滨海耐盐园林植物选择配置中存在的问题，

提出了华南滨海耐盐园林植物建设构想以及华南滨海景观带耐盐带园林植物适宜的配置模式，为进一步开展华南滨海耐盐园林绿化植物的应用研究提供基本思路。

3. 以厦门海湾大道为例，开展华南滨海景观带园林植物的选择与配置的应用研究

实地调查了厦门海湾大道的基本概况，分析讨论了厦门海湾大道园林植物应用现状，提出了厦门海湾大道园林植物选择的原则、适宜的植物种类和具体配置的设想，以供园林部门建设时参考。

本论文研究工作获得的主要结论如下：

1. 本文共筛选耐盐园林绿化植物 55 科 91 种，包括乔木类 45 种，灌木类 32 种，草本植物 14 种。结果发现，所调查的 91 种植物中，80 种属高度耐盐，11 种中度耐盐，大部分绿化植物耐盐度都在 4mg/g 以上。同时，我们还发现，在所调查的 91 种植物中，只有 60 种已在园林绿化中得到广泛利用，占 65.9%，另外 31 种尚未没被利用，具有较大的推广价值。

2. 调查结果表明，华南滨海耐盐园林植物选择配置存在一些亟待解决的问题，如（1）绿化植物单一，不能充分体现地方特色；（2）绿化植物物种选择不当，植物生长不良；（3）植物配置不当，生态系统脆弱；(4) 配置形式单一等。提出了在潮间水域以红树林，在陆域的海岸沙带以椰子树为代表的棕榈科植物，在陆域的岩石低丘坡地、悬崖陡坡以热带阔叶乔木为优势种的华南滨海耐盐园林植物的建设构想；提出了滨海耐盐园林绿化植物应用构想 6 大类（棕榈科植物、红树植物、半红树植物、滨海植物及广布群类植物、滨海砂生植物和防护林）；并根据受海水影响程度和岸滩景观类型，提出了 3 种景观植物群落配置模式（临海岩岸景观植物群落、临海砂岸景观植物群落、临海泥岸景观植物群落），筛选出不同海岸景观可选择的植物种类及其群落水平、竖向结构，并列举出适合的种植模式示例。

3. 调查显示，厦门海湾大道园林植物配置上存在一些问题（如未充分考虑立地条件、未有效发挥植物创景及组景的功能以及防护林树种单一等），提出厦门海湾大道园林植物选择应该遵循的六大原则，包括生态学原则、经济效益原则、地域性原则、适地适树原则、科学性与艺术性相结合原则和以人为本原则。筛选出适宜厦门海湾大道的园林植物，其中耐盐的红树植物 9 种、半红树植物 6 种、其

他乔木 28 种、灌木 21 种和草本植物 18 种；提出了厦门海湾大道 2 种不同滨海景观带（石岸砌筑型、自然过渡型）的园林植物配置的具体想法。

关键词：华南滨海区；耐盐；园林植物；筛选；应用

ABSTRACT

Soil salinization has become the issues of the major resources and environmental threating to the survival of human. With the urbanization process accelerated, salty soil areas in the coastal areas of south china are growing up. Soil salinization, lower vegetation coverage and poor quality of garden forestation have become the bottleneck of the construction of landscaping forestation and ecological environment in these areas

Plant resources are very rich in the coastal areas of South China, but the salt Tolerances of most trees are also unclear. Many fine salt-tolerant plants do not yet obtain the use. It is necessary to screen for salt-tolerant landscaping plant as soon as possible. The direct observations of salt-tolerant plants in salty soil are the most economic and effective measures to screen for salt-tolerant landscaping plant with prospects for the development and utilization in the coastal areas of South China. It is important to develop salt-tolerant landscaping plant resources investigation screening and the applied research for improving the landscape quality, reducing the construction cost and the maintenance charge in the coastal areas of South China, protecting ecological environment and maintaining biodiversity and so on.

The author records in detail the types of plant, the growth condition, the degree of salt injury, the habitat characteristic and the surrounding types of plant by field-investigating the salt-tolerant plants in the coastal areas of South China. Salt contents were measured for the acquainted soil and water sample, the salt-tolerant scope of plant was evaluated in the area of saline-alkali soil, salt-tolerant landscaping plant resources were screened and explored in the coastal areas of South China and chosen and configured landscaping plant to use the Gulf Boulevard in Xiamen. These studies aimed at providing the scientific basis for choosing and configuring landscaping plant and offering reference for salty soil greening in the coastal areas of South China.

The main studies carried out in this dissertation are summarized as follows:

1. Investigation and screening of salt-tolerant landscaping plant resources in the coastal areas of South China.

This investigation lasted 3 years, the survey locations, including the coastline of Hainan Island, Shenzhen Guangdong, Zhanjiang Guangdong, Guangxi coastline (including Weizhou Island), Xiamen Fujian, Quanzhou Fujian and so on. In combining the field-investigating, laboratory testing and literature inspecting methods, the salt-tolerant scope of plant was evaluated in the area of saline-alkali soil, the salt-tolerant landscaping plant were screened and recorded in detail the types of plant, the growth condition, the degree of salt injury, the habitat characteristic and the surrounding types of plant. Soil salinity was determined by electrical conductivity. Based on the method of Zhao and combining the plant growth and development condition, the extent of salt-tolerant plants was divided into four levels. These results may provide a reliable basis for further applied the salt-tolerant landscaping plant in the coastal areas of South China.

2. The applied research of salt-tolerant landscaping plant in the coastal areas of South China.

The author discussed Factors affecting selection and allocation of landscaping plant species in the south China, analyzed configuration characteristics, offered the existing problems, the constructing concepts and the appropriate configuration mode, in order to provide a basic thinking for the applied research of salt-tolerant landscaping plant in the coastal area of south China s.

3. To the Gulf Boulevard in Xiamen as an example, the applied research of selection and allocation of landscaping plant species in the coastal areas of South China.

The author investigated the basic profiles of the Gulf Boulevard in Xiamen, analyzed and discussed the application present situation of landscaping Plants, offered the selecting principles, the appropriate plant species and the vision for the specific configuration for reference.

The main results obtained in this dissertation are summarized as follows:

1. This paper screened a total of 55 Familia 91 species, including 45 kinds of trees, 32 kinds of shrubs, 14 kinds of herbs. The results showed that, in the survey of 91 species, 80 kinds of plants possesses a high degree of salt tolerance, 11 kinds of plants possesses a moderate degree of salt tolerance. The degree of salt tolerance in the

majority of plants is above 4 mg / g. At the same time, in the survey of 91 species, only 60 species have been widely used in the landscape, accounting for 65.9 percent, while 31 species, with great promotional value, have not yet not being used.

2.The survey results show that there are some issues requiring urgent solution, such as (1) single plant can not fully reflect local characteristics, (2) green plant selection were improper , plant growth were bad, (3) Plant configured properly, the fragile ecosystem, (4) The disposition form is unitary ect. The new conception was proposed that the mangrove forest was taken as dominant species in the inter-tidal waters, palm plants in order to represent the coconut palm was supposed in the coast sand of the land, the salt ornamental plant construction was taken the tropics broad-leaf tree as dominant species in the slopes of the rock low earthen mound land and the cliff steep slope to bear in coastal areas of South China. The idea of application of was put forward about the coastal landscape salt-tolerant plants of 6 categories (palm plants, mangrove, semi-mangrove, coastal plants and widespread group of plants, sand plants and coastal shelterbelts. Under the influence of the sea and beach landscape, made three kinds of south China coastal landscape zone (including the cliff landscape plant community, the sand shore landscape plant community, the marshy bank landscape plant rise at near sea). At the same time, the section plants of the different landscape were screened and its community structure in the horizontal and vertical was discussed, the suitable planter pattern demonstration was cited.

3. The investigation showed that there are some problems (for example, failure to give full consideration to site conditions, failure to play effective functions of plants creating and a single tree shelterbelt , etc.) about allocating landscaping plant species in the Gulf Boulevard in Xiamen and six basic principles for landscaping plant selection were put forward in the Gulf Boulevard in Xiamen, including the principles of ecology, economic principles, the principle of regional, the principles of the right place and suitable trees, science and art combined principles and people-oriented principles. Landscaping plants suitable for the Gulf Boulevard in Xiamen were screened, of which 9 species of mangrove, 6 species of semi-mangrove, 28 species of tree, 21 species of shrubs and 18 species of herbs. Also, the concrete configuration

ideas of landscaping plants was proposed in the 2 kind of different landscape belt (stone shore masonry and building, natural transition form) in the Gulf Boulevard in Xiamen.

Keywords: The coastal areas of South China; Salt tolerance; Landscaping plant; Screen; Application

第一章 绪　论

§1.1 华南滨海区的自然资源和气候条件

§1.1.1 区域气候与土壤

华南地区是指福州市以南的福建东南部、台湾省、两广山地丘陵的中部和南部、海南岛和南海诸岛[1]。本文所指的滨海区主要是指临海的海岸线地区，包括潮上带土地和潮间带滩涂等自然保留地以及鱼塘、耕田、港口码头、滨海度假村和公园、滨海道路等人工开发区。其中潮间带又称为“海滩”，是指高潮线与低潮线之间水陆交替的部分；“海岸”是指高潮线以上狭窄的陆域部分，潮上带是指位于高潮位以上延伸至陆上 10km 左右范围内的地带，潮汐作用不及，平时只受到含盐分的海风吹拂和有时被含盐分的雾所笼罩，只有当风暴潮来临之时，海水暂时溅漫，故也称为浪溅带（如图 1-1）。潮上带部分土地是盐碱地，1m 土层的含盐量一般为 0.3 %～1.2 %。

本区地处亚热带季风区，东风为常向风，夏以东南风为主，冬以东北风为主，还经常发生台风灾害，且 95 %集中在 6～11 月，8 级及其以上的大风日数，一般多在 40d 以上。所以，在进行华南滨海区园林绿化植物的选择和应用时，必须考虑其对盐碱和台风有良好的抗性。

图 1-1 海洋环境分区与海岸带地形

Chart 1-1　Marine environment district and coastal zone terrain